

in this vicinity on the afternoon of the 4th and during the night following.

Bismarck, Dak.: during the thunder-storm which began at 10 a. m. and ended at 1 p. m. on the 5th, heavy rain and hail fell from 11.15 to 11.39 a. m. The wind attained a maximum velocity of thirty-one miles per hour from the northwest.

Toledo, Ohio: during the afternoon of the 6th a tornado apparently started near Adrian, Lenawee Co., Mich., and passed southeastward into this (Lucas) county. A large brick school house four miles south of Adrian was demolished. At Sylvania, about eighteen miles northwest of Toledo, buildings were damaged, and all telegraph wires between Adrian and Sylvania were blown down, completely cutting off communication. The buildings of the Northwestern Insane Asylum, near Toledo, were damaged to a considerable extent. From the vicinity of Toledo the track of the tornado, which was from one hundred to two hundred yards in width, was south by east along the line of the Toledo and Ohio Central Railroad. No fencing or tall trees were left standing in this track, and dwellings and barns were unroofed. At Waterville, Lucas Co., and other villages to the southward, much damage was done.

Tiffin, Seneca Co., Ohio: a severe storm occurred on the night of the 6-7th, during which trees, etc., were blown down.

Findlay, Hancock Co., Ohio: at 3 a. m. on the 7th the La-Grange rolling mills and Moore's cable chain works, situated west of the city, were completely wrecked by a tornado. A number of other buildings were blown from their foundations.

Albany N. Y.: during the afternoon of the 7th a severe storm, accompanied by hail, occurred at this place; the hail-stones, which measured half an inch in diameter, caused considerable damage to buildings and vegetation. The most violent part of the storm was of about thirty minutes' duration—from 2.30 to 3 p. m.

Saratoga Springs, Saratoga Co., N. Y.: a thunder and hail storm began at 1.30 and ended at 1.50 p. m. on the 7th; the hail-stones measured three-quarters of an inch in diameter, and caused much damage to windows and sky-lights; about 1,000 panes of glass were broken in a hot-house near this place. The storm's track was from about one-half to three-quarters of a mile wide.

Medina, Orleans Co., N. Y.: a large amount of damage was done to crops in this county by the storm on the night of the 7-8th. It is estimated that \$60,000 will not cover the losses sustained.

Fort Maginnis, Mont., 12th: it is reported that on account of the recent heavy rains, the grain and hay crops in this county have been damaged about fifty per cent.

Denver, Colo.: high winds prevailed from 12 m. until 8.40 p. m. on the 12th; a maximum velocity of forty-two miles an hour occurred at 2.10 p. m.

Topeka, Kans.: a high wind, velocity ranging from forty to forty-five miles per hour, prevailed for several hours on the 12th, causing some damage to shade trees.

West Monroe, Oswego Co., N. Y.: a severe thunder-storm occurred during the night of the 13-14th; a number of barns and other buildings were struck by lightning and burned.

Titusville, Fla.: during the afternoon of the 16th the wind, which had been fresh northeasterly, suddenly increased in force at 2.20 p. m., reaching a velocity of forty-two miles per hour; this high wind continued until 2.45 p. m.

Keeler, Cal.: the heavy rain and thunder-storm on the 22d was one of the severest that has ever visited this county. Hail fell for about fifteen minutes, some of the hail-stones being as large as walnuts. A washout occurred on the railroad two miles northwest of this place.

Hatteras, N. C.: high wind prevailed during the afternoon of the 23d, reaching a maximum velocity of forty-six miles per hour from the north at 7.30 p. m.

Chicamcomico, N. C.: during a northeasterly gale on the 23d the schooner "Charles," from Beaufort, N. C., was driven ashore near Oregon Inlet.

Brownsville, Tex.: a thunder-storm passed over this place from the northwest at 7 p. m. on the 26th; the heavy rain which fell between 9.30 and 10 p. m. caused the Rio Grande River to overflow adjacent lowlands.

Amesbury, Essex Co., Mass.: the thunder-storm on the night of the 7-8th was of unusual severity in this vicinity; numerous buildings and other objects were struck by lightning. Reports from Bridgewater, Plymouth Co., state that a severe storm occurred at that place during the afternoon of the 7th, and that considerable damage was done by lightning.

WATER-SPOUTS.

Captain Mackay, of the s. s. "Alvena," reports: "September 18th, 11 p. m. Greenwich time, in N. 18° 30', W. 74° 08' (Hayti), with light variable winds; a heavy cloud appeared about four miles out at sea, extending towards Caymite Island, from which were seen seven water-spouts, one being very large and drawing up large quantities of water."

COTTON REGION REPORTS.

In the following table are given the means of the maximum and minimum temperatures, and the average rainfall for the cotton-belt districts during the month. For the purpose of comparison the means for the five preceding years are also given.

A slight excess over the average rainfall occurs in the districts of New Orleans, Atlanta, Montgomery, and Mobile; elsewhere the deficiencies occur, those for the districts of Savannah and Charleston exceeding two inches.

The temperature, as compared with the average, shows departures both above and below the normal, though generally slight.

Temperature and rainfall data for the cotton districts, September.

Districts.	Rainfall.			Temperature.								Extremes for Sept., 1887.		
	Average for Sept. of five preceding years.	Average for Sept., 1887.	Departures.	Maximum.			Minimum.							
				Mean for Sept. of five preceding years.	Mean for Sept., 1887.	Departures.	Mean for Sept. of five preceding years.	Mean for Sept., 1887.	Departures.					
New Orleans.....	Inch. 3.16	Inch. 3.66	+ 0.50	87.5	87.4	- 0.1	66.8	65.6	- 1.2	99	101	2	99	101
Savannah.....	3.76	1.73	- 2.03	86.0	86.9	+ 0.9	67.5	64.2	- 3.3	101	101	0	101	101
Charleston.....	4.08	0.96	- 3.12	84.7	84.5	- 0.2	64.0	62.1	- 1.9	101	101	0	101	101
Atlanta.....	2.62	2.95	+ 0.33	83.9	83.5	- 0.4	63.2	61.4	- 1.8	97	101	4	97	101
Wilmington.....	4.32	1.48	- 2.84	82.6	85.8	+ 3.2	62.2	59.4	- 2.8	101	101	0	101	101
Memphis.....	2.52	2.28	- 0.24	84.7	85.8	+ 1.1	61.2	61.9	+ 0.7	100	100	0	100	100
Galveston.....	4.23	3.05	- 1.18	87.8	88.0	+ 0.2	66.4	68.0	+ 1.6	100	100	0	100	100
Vicksburg.....	3.60	3.31	- 0.29	87.5	88.1	+ 0.6	65.2	67.9	+ 2.7	100	100	0	100	100
Montgomery.....	1.77	2.73	+ 0.96	86.4	85.3	- 1.1	64.1	63.4	- 0.7	99	101	2	99	101
Augusta.....	2.86	1.19	- 1.67	85.0	84.5	- 0.5	65.3	63.0	- 2.3	101	101	0	101	101
Little Rock.....	2.64	1.15	- 1.49	86.2	87.5	+ 1.3	60.3	60.8	+ 0.5	101	101	0	101	101
Mobile.....	1.95	2.69	+ 0.74	88.2	89.1	+ 0.9	65.1	60.4	- 4.7	105	105	0	105	105

INLAND NAVIGATION.

STAGE OF WATER IN RIVERS AND HARBORS.

Fort Buford, Dak., 25th: the Missouri River has been falling since the 4th, and navigation at this time is seriously impeded on account of low water.

Shreveport, La.: navigation on the Red River was suspended on account of low water on the 1st; by the 29th the river had risen sufficiently to permit the resumption of navigation.

Louisville, Ky., 19th: the present low stage of water in the Ohio River is almost without precedent, and navigation is only practicable for boats of light draught.

In the following table are shown the danger-points at the various river stations and the highest and lowest depths for September, 1887, with the dates of occurrence, and the monthly ranges:

Heights of rivers above low-water mark, September, 1887 (in feet and tenths).

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Red River:</i>						
Shreveport, La.	29.9	30	5.5	8 to 11	*—0.6	6.1
<i>Arkansas River:</i>						
Fort Smith, Ark.	22.0	11	4.5	1	1.7	2.8
Little Rock, Ark.	23.0	15	3.8	2	1.7	2.1
<i>Missouri River:</i>						
Omaha, Nebr.	18.0	13	11.9	30	7.3	4.6
Leavenworth, Kans.	20.0	15	13.4	27	8.2	5.2
<i>Mississippi River:</i>						
Saint Paul, Minn.	14.5	4	2.6	24 to 26, 30	1.8	0.8
La Crosse, Wis.	24.0	10	5.7	1	2.7	3.0
Dubuque, Iowa	16.0	13	5.8	1, 2	2.6	3.2
Davenport, Iowa	15.0	15 to 19	3.8	1	1.4	2.4
Keokuk, Iowa	14.0	20 to 22	3.6	4	1.0	2.6
Saint Louis, Mo.	32.0	19	11.6	5 to 7	6.7	4.9
Calro, Ill.	40.0	22	7.8	11	3.8	4.0
Memphis, Tenn.	34.0	24, 25	6.8	13	4.4	2.4
Vicksburg, Miss.	41.0	29	3.1	17, 18	*—0.1	3.2
New Orleans, La.	13.0	1	4.1	10, 11	1.9	2.2
<i>Ohio River:</i>						
Pittsburg, Pa.	22.0	7	6.1	12, 23	5.5	0.6
Cincinnati, Ohio	50.0	1, 2	4.1	17	2.8	1.3
Louisville, Ky.	25.0	12	3.0	26	2.4	0.6
<i>Cumberland River:</i>						
Nashville, Tenn.	40.0	28, 29	0.9	14 to 16	*—0.3	1.2
<i>Tennessee River:</i>						
Chattanooga, Tenn.	33.0	1	4.0	19, 25	1.3	2.7
<i>Monongahela River:</i>						
Pittsburg, Pa.	29.0	7	6.1	12, 23	5.5	0.6
<i>Savannah River:</i>						
Augusta, Ga.	32.0	30	14.0	26	5.6	8.4
<i>Sacramento River:</i>						
Red Bluff, Cal.		2 to 9, 12 to 10	0.5	1, 10, 11	0.4	0.1
Sacramento, Cal.		1 to 11	7.3	12 to 30	7.2	0.1
<i>Willamette River:</i>						
Portland, Oregon		1	5.7	26 to 28	2.0	3.7

* Below bench mark.

FLOODS.

Fort Maginnis, Mont., 2d: the rains of the past four days have been the heaviest ever known in this section. The Missouri River rose twelve feet in three hours, carrying away

property valued at from \$8,000 to \$9,000. Considerable damage was also done to grain and hay.

Poplar River, Mont.: the heavy rain northwest of this station caused a rise of four feet in the Missouri River on the 2d.

Fort Buford, Dak., 3d: on account of the recent heavy rains the Missouri River has risen very rapidly, and reports from the Yellowstone Valley state that the creeks are overflowing and partly flooding the surrounding country.

Tucson, Ariz.: heavy rains caused freshets in the Santa Cruz and Rillito rivers on the 9th. Several miles of the Southern Pacific Railroad track and some bridges in the vicinity of Pantano were washed away.

The Chicago "Times" of the 13th contained the following:

TUCSON, ARIZ., September 13.—The extent of the destruction to the railroad by washouts is much greater than at first supposed. * * * One filling fifty feet high on the Dragoon grade is washed out for eight miles. It will take three weeks to repair the washed out places between Benson and Tucson so that trains can pass over the road. * * * The present is the most destructive washout yet suffered by the Southern Pacific Road, and it will cost not less than \$200,000 to repair the damage. A through wire to the east was made to day. The heavy rains of yesterday extended into Sonora, where five miles of track and three bridges were washed out on the Sonora Road. The streets of Tucson are flooded with perishable freight for the eastern market.

Brownsville, Tex.: the Rio Grande River began to overflow on the 13th, and continued to rise on subsequent dates; by the 27th much of the adjacent country was flooded. On the latter date the river was higher than has been known for twenty years. At the close of the month the river was still overflowing.

New Orleans, La.: the high tides caused by the strong easterly winds of the 18-19th, with rainfall on the latter date, resulted in washouts along the Louisville and Nashville Railroad between this city and Mobile.

Comfort, Kendall Co., Tex.: all streams in this region were much swollen by the heavy rains on the night of the 25-26th, and numerous bridges were washed away.

ATMOSPHERIC ELECTRICITY.

AURORAS.

Auroras were observed during the month, as follows: 1st, Butlerville, Ind. 6th, Berlin Mills, N. H. 9th, Henry and Webster, Dak.; Clayton, N. J. 11th, Berlin Mills, N. H. 12th, Poplar River, Mont. 13th, Starkey, N. Y. 14th, Webster, Dak.; Duluth, Minn. 15th, Bismarck and Fort Buford, Dak.; Traverse City, Alpena, and Marquette, Mich.; Duluth and Moorhead, Minn.; Poplar River and Fort Assinaboine, Mont.; Madison, Wis. 16th, Fort Totten and Webster, Dak.; Gardiner, Me.; Moorhead, Minn.; Northfield, Vt. 17th, Gardiner, Me.; Thornville, Mich.; Saint Vincent, Minn. 18th, Clayton, N. J. 21st, Fort Totten and Webster, Dak.; Marquette, Mich.; Duluth and Moorhead, Minn. 22d, Fort Totten, Dak.; Saint Vincent, Minn.; Poplar River, Mont. 23d, Webster, Dak.; Fort Maginnis, Mont. 24th, Windsor, Ill.; Taunton, Mass.; Thornville, Mich. 25th, Voluntown, Conn.; Bismarck, Fort Totten, and Webster, Dak.; Butlerville, Ind.; Bar Harbor, Cornish, Gardiner, Orono, Eastport, and Portland, Me.; Blue Hill Observatory, Fall River, Newburyport, North Truro, Somerset, and Taunton, Mass.; Birmingham, Harrisville, Lansing, Thornville, Traverse City, Alpena, Port Huron, and Marquette, Mich.; Fort Maginnis and Poplar River, Mont.; Concord, N. H.; Tiffin, Ohio; Fort Laramie, Wyo. 26th, Thornville, Mich.; Poplar River, Mont. 27th, Fort Totten, Fort Buford, and Webster, Dak.; Alpena, Mich.; Saint Vincent and Duluth, Minn.; Fort Maginnis, Poplar River, and Fort Assinaboine, Mont.; Mount Washington, N. H. 28th, Moorhead, Minn.

The most noteworthy auroral displays of the month were those of the 25-27th, which were observed at stations in the states and territories along the northern border from Montana eastward to the New England coast. Reporting stations were most numerous on the evening of the 25th, although at that

time over Dakota, Minnesota, Wisconsin, and northern New York, cloudiness prevailed, through which the aurora could not be seen; but over the greater part of the Lake region, in the upper Missouri valley, and New England, the weather was clear and the aurora was observed at many stations.

On the evening of the 26th an area of cloudiness overspread the upper Mississippi valley, Lake region, and portions of New England, and the aurora was noted at but two stations, viz., Poplar River, Mont., and Thornville, Mich.

On the following evening cloudiness covered the greater part of the country east of the Mississippi, but the weather was clear in the northern part of the upper lake region and to the westward, where numerous stations observed auroral displays.

Concerning the displays of the 25-27th, the following notes are given:

Fort Totten, Dak.: though the sky was partially obscured on the evening of the 25th it was sufficiently clear to indicate the existence of a brilliant and prolonged auroral light, with shooting beams reaching nearly to the zenith. The display was seen from 9.30 to 11.30 p. m.

Escanaba, Mich.: a faint and poorly defined auroral light was observed from 8.00 p. m. on the 25th until 1.30 a. m. the following date; the aurora assumed fantastic shapes and colors extending upward to an altitude of 80°; it covered only a narrow part of the horizon.

Bismarck, Dak.: a bright yellow auroral light was observed at 8.25 p. m. on the 25th; it rapidly spread from azimuth 120° to 255°; beams of light shot upwards to a height of 90°. At 10 p. m. the light began to fade, and by 11 p. m. it had disappeared.

Mackinaw City, Mich.: a brilliant aurora appeared at 7.30 p. m. on the 25th; it was of a light yellow color and presented the appearance of a huge curtain hanging in folds. The light extended from the northeast to the northwest, and reached an altitude of 90°; for a short time the light extended to 10° south of the zenith. The aurora gradually assumed an elliptical shape, still retaining its curtain-like appearance, its long diameter being about 100° in length, and crossing the magnetic meridian at right angles at altitude 85°. The maximum intensity occurred at about 8.10 p. m.; after that time it gradually faded, and